

REMARKS

The Examiner is thanked for the thorough examination of the present application. The Office Action, however, rejected all claims 1-10. In this Amendment, Applicants have amended the specification editorially to correct informalities indicated by the Office Action and found during review of the application. Claim 4 has been canceled without waiver or prejudice to the subject matter originally contained therein. Claims 11 and 12 have been added to further protect certain embodiments. No new matter is added by way of these amendments made to the claims or otherwise to the application. Claims 1, 5, and 10 are the independent claims. Claims 1-12 are now pending in the application. For at least the following reasons, it is submitted that this application is in condition for allowance.

The Office Action has objected to the disclosure because of certain informalities. In response, Applicants have amended the specification to correct the noted informalities and/or found during review of the application. Thus, withdrawal of this objection is respectfully requested.

Claims 4 and 9 are rejected under 35 U.S.C. 112, second paragraph, as allegedly indefinite. In response, claim 4 has been canceled and claim 9 has been amended to more specifically define embodiments of the invention. Accordingly, the 112 rejections of the claims should be withdrawn.

Claim 4 was also rejected under 35 U.S.C. 101 as allegedly directed to non-statutory subject matter. The cancellation of claim 4 has been rendered moot by the cancellation of that claim.

Discussion of the claim rejection under 35 USC 103

Claims 1-2 and 4-10 were rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Liu (U.S. Patent No. 5,585,792) (hereinafter, Liu). As claim 4 has been canceled, the rejection of that claim has been rendered moot. In addition, it is submitted that the rejection as to claims 1, 2, and 5-10 is misplaced. For at least the following reasons, withdrawal of these rejections is respectively requested.

Independent claim 1 recites:

1. A keypad device to be applied in an electrical device, wherein the keypad device comprises:

a keypad module including a plurality of keys and respective output pins of the keys, the keypad module being used for outputting an interrupt signal when at least one of the keys is pressed, and for outputting a parallel signal corresponding to the keys through the output pins when the keypad module receives a drive signal;

a parallel/serial conversion device coupled to the output pins of the keypad module for receiving the parallel signal and outputting a serial signal according to the parallel signal; and

a controller, coupled to the keypad module and the parallel/serial conversion device respectively, *wherein the controller includes an input/output pin, coupled to the keypad module, for receiving the interrupt signal and outputting the drive voltage in response to the interrupt signal, and the controller receives the serial signal and determines the status of the keypad module according to the serial signal received;*

wherein the controller, in response to the interrupt signal, sets the input/output pin as an output pin to output the drive voltage to the keypad module to enable the keypad module to output the parallel signal.

(*Emphasis added.*) Applicant submits that claim 1 defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

In this regard, Liu does not teach or even suggest how to reduce the use of the encoder's inputs and outputs with respect to the keyboard. Likewise, Liu does not teach or even suggest a device coupled between the encoder 112 and the keyboard matrix to reduce the required number of inputs and outputs of the encoder 112 and reduce the power and resource consumption of the

encoder 112, with respect to the keyboard. The prior art lacks any suggestion that the reference should be modified in a manner required to meet the claims. "The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." In *Re Gordon*, 221 U.S.P.Q. 1125,1127 (Fed.Cir.1984).

As emphasized above, Applicants' claim 1, as amended, provides a keypad device including a keypad module, a controller, and a parallel/serial conversion device coupled between the keypad module and the controller. The keypad module including a plurality of keys and respective output pins of the keys, and the parallel/serial conversion device receives a parallel signal corresponding to the keys outputted through the output pins in parallel and outputs a serial signal according to the parallel signal. In this way, the disclosure recited in claim 1 is at least "capable of reducing the required number of GPIO pins of the controller and reducing power and resource consumption of the controller." (See paragraph 0005 of the specification)

In contrast, Liu discloses an improved energy-saving keyboard with a low parts count, which accomplishes a sophisticated regime of low-power mode intervals in response to key closures and communications from the computer to which the keyboard is connected. An interrupt pin of the keyboard encoder prompts the transition from low-power mode to normal mode. The communications from the computer is synchronous communications mediated by a clock line, and the interrupt pin is tied not to the clock line but to the data line of the synchronous channel. The interrupt pin is also tied to a resistor array providing pull-up biases to the keyboard matrix; in normal-power mode a discrete output of the encoder forces the common point of the resistor array to a fixed voltage level. In low-power mode, on the other hand, the discrete output is not asserted, and the resistor array is pulled high by a pull-up impedance of relatively high

resistance to the fixed voltage level. In this way, any key closure at the keyboard triggers the interrupt. (col. 3, lines 34-51)

Specifically, Liu's FIG. 3 teaches that the keyboard encoder (or encoder) 112, exemplified as a microcontroller or an application specific integrated circuit, is connected to the keyboard matrix, wherein a matrix of keys connected by row and column lines (15 and 16) to the encoder 112. In a more specific example illustrated in FIG. 5 of Liu, the encoder 112 provides a full range of column lines C0 through C16, and a full range of row lines R0 through R7, permitting as many as 136 matrix cross-points where keys could be located.

In other words, Liu discloses an encoder, such as a microcontroller, providing a number of inputs and output pins for connecting to and driving a keyboard matrix and providing an input for receiving an interrupt signal from the keyboard matrix when key closure occurs. In contrast to Applicants' claim 1 disclosing that the parallel/serial conversion device coupled between the keypad module and the controller, Liu does not teach or even suggest a device coupled between the encoder 112 and the keyboard matrix to reduce the required number of inputs and outputs of the encoder 112 and reduce the power and resource consumption of the encoder 112, with respect to the keyboard. In particular, Liu does not teach or even suggest how to reduce the use of the encoder's inputs and outputs with respect to the keyboard since Liu only teaches the use of a keyboard matrix and the encoder 112 must scan the keyboard matrix through the encoder 112's outputs (16) to the keyboard matrix so as to detect key closure. (See col. 4, line 66 to col. 6, line 41; FIGS. 3 and 5)

Thus, Liu fails to disclose or even suggest the structure of a keypad module, as amended claim 1 requires. In amended claim 1, the keypad module includes a plurality of keys and respective output pins of the keys, wherein through the output pins, a parallel signal

corresponding to the keys is outputted by the keypad module when the keypad module receives a drive signal from a controller. In contrast, Liu only discloses the keyboard matrix connected to the encoder 112. For at least this reason, the rejection of independent claim 1 should be withdrawn.

In addition, Liu neither teaches nor suggests that a parallel/serial conversion device is coupled between a controller and the keypad, wherein the controller receives a serial signal and determines the status of the keypad module according to the serial signal received from the parallel/serial conversion device coupled to the output pins of the keypad module, as amended claim 1 requires. Instead, Liu only discloses the keyboard matrix connected to the encoder 112 through a number of inputs and outputs (15 and 16), as shown in Liu's FIGS. 3 and 5. For this additional reason, the rejection of claim 1 is misplaced.

In rejecting claim 1, the Office Action acknowledges that Liu does not disclose a parallel/serial conversion device. However, the Examiner asserts that such a device missing from Liu is inherently exists as part of the controller (112, encoder of Liu).

According to MPEP §2112, "[T]o establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by mere probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'" *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999).

In finding obviousness by inherency in view of the single reference of Liu, the Office Action apparently failed to employ the foregoing critical legal principles. In particular, the Office Action made no attempt to show that the disclosure of the encoder, exemplified as a

microcontroller or ASIC, of Liu that are directly connected to the keyboard matrix **necessarily disclosed** a parallel/serial conversion device of claim 1 coupled between the keypad module and the controller, as well as features related to such device and other elements in the rejected claim 1, which reduces the required number of pins and resource consumption of the controller with respect to the keypad module. The Office Action cited no extrinsic evidence so indicating.

Instead, the Office Action asserted that “since the data input into controller is parallel data and the data for the computer (11) is serial (column 4, lines 9-15), some sort of parallel/serial conversion device must exist as part of the controller(112)”. In addition, the Office Action alleged that “since such a device would inherently exist within the controller (112), the determination of the keypad module status would be accomplished using this serial signal.” In these assertions, the Office Action failed to recognize that the parallel/serial conversion device of claim 1 is coupled between the controller and the keypad module and is also separate from and independent of the controller and the keypad module. In addition, the Office Action failed to recognize that the keypad device of claim 1 including the parallel/serial conversion device, as well as related features, missing from Liu, has at least the following advantages of reducing the required number of pins, power and resource consumption of the controller, with respect to the keypad module, and of being applicable to the occasion when a number of keys are pressed at the same time (see paragraph 0017 and 0018, for example). Indeed, the Office Action relying on probability or possibility to make analysis is insufficient to establish inherency according to the requirements of the MPEP and the court decisions cited above.

In rejecting claim 1 as obviousness, the Office Action fails to show any proper suggestion or motivation to one of ordinary skill in the art to modify the teachings of Liu to arrive at the

claimed invention, as claim 1 requires. Rather than the teaching of claim 1 of using the parallel/serial conversion coupled between the keypad module and the controller to achieve the advantages described above, Liu discloses an improved energy-saving keyboard with the encoder 112 connected to a keyboard matrix with a number of inputs and outputs of the encoder 112. Hence, there is no suggestion or motivation by Liu to one of ordinary skill in the art at the time of the invention to modify the teachings of Liu to arrive at the claimed invention, as claim 1 requires.

For at least the foregoing reasons, the claimed structure, as claim 1 requires, patentably defines over Liu.

In addition, claims 5 and 10 include features similar to those discussed above that are missing from Liu. Consistent with the discussion as to patentability of claim 1, claims 5 and 10 are also patentable over Liu. Moreover, since claims 2 and 6-9 depend from claims 1 and 5 respectively, claims 2 and 6-9 patentably define over Liu for at least the same reasons. Accordingly, the rejection of claims 1, 2, and 5-10 should be withdrawn.

Claim 3 has been rejected under 35 U.S.C. 103(a) as allegedly unpatentable over Liu as applied to claim 1, and further in view of Griffin (U.S. Patent No. 6,489,950). The cited secondary reference of Griffin fails to disclose or even suggest the features recited in claim 1, which are missing from Liu (as discussed above). For at least this reason, claim 3 patentably defines over the cited references. The rejection accordingly should be withdrawn.

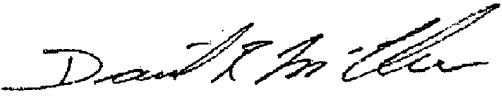
Claims 11 and 12 are added to be dependent upon claim 1 to further protect certain aspects of embodiments. Claims 11 and 12 should be allowable for at least the reasons advanced above as to the patentability of independent claim 1.

Conclusion

For the foregoing reasons, it is respectfully submitted that this application with claims 1-12 is in condition for allowance. Notice of such allowance and passing of the application to issue, are earnestly requested. Should the Examiner feel that a conference would be helpful in expediting the prosecution of this application, the Examiner is hereby invited to contact the undersigned counsel to arrange for such an interview.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

By: 
Daniel R. McClure
Registration No. 38,962

Thomas, Kayden, Horstemeyer & Risley, LLP
100 Galleria Pkwy, NW
Suite 1750
Atlanta, GA 30339
770-933-9500